Claims

1. Autostereoscopic multi-user display having a sweet-spot unit that is direction-controlled by a tracking and image controller (160), wherein the sweet-spot unit has an illumination matrix (120,130) that includes a multitude of illumination elements these can be activated individually, and an imaging device having lens elements (111-115) for imaging alternately active illumination elements in the form of directed bundles of rays onto extended sweet-spots (S_R/S_L) which correspond with different eye positions (E_{L1}/E_{R1}, E_{L2}/E_{R2}), so that right and left images of a stereoscopic image sequence provided on a transmissive image display matrix (140) can be rendered visible at right/left eye positions (E_{L1}/E_{R1}, E_{L2}/E_{R2}) of observers, whereby the tracking and image controller (160) defines a direction (D1, D2, ...or D5) for each bundle of rays (B1-B5) by activating at least one illumination element of the illumination matrix (120, 130) per eye position (E_{L1}/E_{R1}, E_{L2}/E_{R2}), lens element (111-115) and line, so that all bundles of rays (B1-B5) coinside at the position of that sweet-spot(S_R/S_L), wherein the imaging device comprises:

   - an imaging means (110) having a multitude of lens elements (111-115) with short focal distance, so that the active illumination elements are imaged onto the sweet-spots (S_R/S_L) in an enlarged fashion, and
   - a field lens (170) which is disposed behind the imaging means (110) in the direction of light propagation and which has a much longer focal distance than the lens elements (111-115), in order to keep constant and at a minimum the distance between adjacent bundles of rays (B1, B2, B4, B5), so that the definition of directions (D1-D5) of the bundles of rays is supported with the illumination matrix (120).

2. Autostereoscopic multi-user display according to claim 1, wherein the lens elements (111-115) have a short focal distance, and imaging means (110) and illumination matrix (120, 130) are disposed at the about this distance to each other, in order to ensure a great lateral tracking range of the sweet-spot unit.

3. Autostereoscopic multi-user display according to claim 1, wherein the tracking and image controller (160) controls the illumination matrix (120, 130) so that for each eye position a bundle of rays (B3) in the centre of the imaging means (110) leaves the imaging means (110) directed at the eye position (E_L/E_R), while all other bundles of rays (B1, B2, B4, B5) leave the imaging means (110) near-parallel to the central bundle of rays (B3), and that the field lens (170) coincides all bundles of rays to form a sweet-spot at the corresponding eye position (E_{L1}/E_{R1}, E_{L2}, E_{R2}).

4. Autostereoscopic multi-user display according to claim 1, wherein the field lens (170) is a Fresnel lens.

5. Autostereoscopic multi-user display according to claim 4, **characterised in that** the cuts of the field lens are designed as regards their focal distance and angle of entry of the bundles of rays so that the bundles of rays are cincided clearly in front of an optimum observer distance, without the bundles of rays themselves converging considerably.

6. Autostereoscopic multi-user display according to claim 1, **characterised in that** it contains a position detector (150) which determines the lateral eye positions (E_{L1}/E_{R1}, E_{L2}/E_{R2}) of observers and the distances of these eye positions to the image display matrix (140), and that the tracking and image controller (160) adapts the directions (D1-D5) of the bundles of rays (B1-B5) to the detected eye positions (E_{L1}/E_{R1}, E_{L2}/E_{R2}) in the viewing space in front of the display by changing the activated illumination elements accordingly.

7. Autostereoscopic multi-user display according to claim 1, **characterised in that** the focal distance of the field lens (170 or 171) lies in the range of between a half and a full optimum distance between an observer and the display.

8. Autostereoscopic multi-user display according to claim 7, **characterised in that** the field lens (170) is a controllable holographic optical element (HOE)

with a controllable focal distance, and that the tracking and image controller (160) sets its focal distance according to the detected distances.

9. Autostereoscopic multi-user display according to claim 1, **characterised in that** the imaging means (110) is a lenticular, tandem-lenticular or double lenticular.

10. Autostereoscopic multi-user display according to claim 1, **characterised in that** the illumination matrix contains a backlight (130) and an electronic shutter (120) having openings, location and transmission of said openings being discretely controllable.

11. Autostereoscopic multi-user display according to claim 10, **characterised in that** the image display matrix (140) and shutter (120) have the same pixel geometry.

12. Autostereoscopic multi-user display according to claim 1, **characterised in that** the illumination matrix is a regular array of actively light-emitting elements, location and intensity of said elements being discretely controllable.

13. Autostereoscopic multi-user display according to claim 1, **characterised in that** the imaging means (110) is wholly or partly made of a material the optical properties of which are controllable.

14. Autostereoscopic multi-user display according to claim 1, **characterised in that** in the illumination matrix is a projection unit (180) including a diffusing layer and/ or Fresnel lens preferably disposed in front of the imaging means (110), seen in the direction of light propagation.

15. Autostereoscopic multi-user display according to claim 1, **characterised in that** several adjacent illumination elements per projection element and image line are activated simultaneously, so to ensure homogeneous illumination of the image display matrix (140) and to enlarge the sweet-spots.